General

Guideline Title

(1) ACC/AHA 2005 guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic): a collaborative report from the American Association for Vascular Surgery/Society for Vascular Surgery, Society for Cardiovascular Angiography and Interventions, Society for Vascular Medicine and Biology, Society of Interventional Radiology, and the ACC/AHA Task Force on Practice Guidelines (Writing Committee to Develop Guidelines for the Management of Patients With Peripheral Arterial Disease). (2) 2011 ACCF/AHA focused update of the guideline for the management of patients with peripheral artery disease (updating the 2005 guideline). A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines.

Bibliographic Source(s)

Hirsch AT, Haskal ZJ, Hertzer NR, Bakal CW, Creager MA, Halperin JL, Hiratzka LF, Murphy WR, Olin JW, Puschett JB, Rosenfield KA, Sacks D, Stanley JC, Taylor LM Jr, White CJ, White J, White RA. ACC/AHA 2005 guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic): a collaborative report [trunc]. Bethesda (MD): American College of Cardiology Foundation; 2005. 192 p. [1308 references]

Rooke TW, Hirsch AT, Misra S, Sidawy AN, Beckman JA, Findeiss LK, Golzarian J, Gornik HL, Halperin JL, Jaff MR, Moneta GL, Olin JW, Stanley JC, White CJ, White JV, Zierler RE, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society for Vascular Medicine, Society for Vascular Surgery. 2011 ACCF/AHA focused update of the guideline for the management of patients with peripheral artery disease (updating the 2005 guideline): a report of the American College of Cardiology Foundation/American Heart Association Task Force [trunc]. J Am Coll Cardiol. 2011 Nov 1;58(19):2020-45. [66 references] PubMed

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

Definitions for the weight of the evidence (A-C) and classes of recommendations (I-III) are provided at the end of the "Major Recommendations" field.

Note from the National Guideline Clearinghouse (NGC) and the American College of Cardiology Foundation/American Heart Association (ACCF/AHA) Task Force on Practice Guidelines: In 2011, the ACC/AHA Task Force performed a focused update of the 2005 guidelines for the management of patients with peripheral artery disease to revise existing guideline recommendations that are affected by evolving data or opinion. The updated recommendations are presented below, along with the original 2005 recommendations. Sections affected by the focused update are labeled "2011 Focused Update," and new or modified recommendations are labeled as such. All other recommendations remain current in their 2005 form.

General Recommendations for Peripheral Arterial Disease

Vascular History and Physical Examination

Class I

1. Individuals at risk for lower extremity peripheral arterial disease (PAD) (see the table below) should undergo a vascular review of symptoms to assess walking impairment, claudication, ischemic rest pain, and/or the presence of nonhealing wounds. *(Level of Evidence: C)*
2. Individuals at risk for lower extremity PAD (see the table below) should undergo comprehensive pulse examination and inspection of the feet. *(Level of Evidence: C)*
3. Individuals over 50 years of age should be asked if they have a family history of a first-order relative with an abdominal aortic aneurysm. *(Level of Evidence: C)*

Table: Individuals at Risk for Lower Extremity Peripheral Arterial Disease

- Age less than 50 years, with diabetes and one other atherosclerosis risk factor (smoking, dyslipidemia, hypertension, or hyperhomocysteinemia)
- Age 50 to 69 years and history of smoking or diabetes
- Age 70 years and older
- Leg symptoms with exertion (suggestive of claudication) or ischemic rest pain
- Abnormal lower extremity pulse examination
- Known atherosclerotic coronary, carotid, or renal artery disease

Lower Extremity PAD

Clinical Presentation

Asymptomatic

Class I

1. A history of walking impairment, claudication, ischemic rest pain, and/or nonhealing wounds is recommended as a required component of a standard review of symptoms (ROS) for adults 50 years and older who have atherosclerosis risk factors and for adults 70 years and older. *(Level of Evidence: C)*
2. Individuals with asymptomatic lower extremity PAD should be identified by examination and/or measurement of the ankle-brachial index (ABI) so that therapeutic interventions known to diminish their increased risk of myocardial infarction (MI), stroke, and death may be offered. *(Level of Evidence: B)*
3. Smoking cessation, lipid lowering, and diabetes and hypertension treatment according to current national treatment guidelines are recommended for individuals with asymptomatic lower extremity PAD. *(Level of Evidence: B)*
4. Antiplatelet therapy is indicated for individuals with asymptomatic lower extremity PAD to reduce the risk of adverse cardiovascular ischemic events. *(Level of Evidence: C)*

Class IIa

1. An exercise ABI measurement can be useful to diagnose lower extremity PAD in individuals who are at risk for lower extremity PAD who have a normal ABI (0.91 to 1.30), are without classic claudication symptoms, and have no other clinical evidence of atherosclerosis. *(Level of Evidence: C)*
2. A toe-brachial index or pulse volume recording measurement can be useful to diagnose lower extremity PAD in individuals who are at risk for lower extremity PAD who have an ABI greater than 1.30 and no other clinical evidence of atherosclerosis. *(Level of Evidence: C)*

Class IIb

1. Angiotensin-converting enzyme (ACE) inhibition may be considered for individuals with asymptomatic lower extremity PAD for cardiovascular risk reduction. *(Level of Evidence: C)*

Claudication

Class I

1. Patients with symptoms of intermittent claudication should undergo a vascular physical examination, including measurement of the ABI. *(Level of Evidence: B)*
2. In patients with symptoms of intermittent claudication, the ABI should be measured after exercise if the resting index is normal. *(Level of Evidence: B)*
3. Patients with intermittent claudication should have significant functional impairment with a reasonable likelihood of symptomatic improvement and absence of other disease that would comparably limit exercise even if the claudication was improved (e.g., angina, heart failure, chronic respiratory disease, or orthopedic limitations) before undergoing an evaluation for revascularization. *(Level of Evidence: C)*
4. Individuals with intermittent claudication who are offered the option of endovascular or surgical therapies should: (a) be provided information regarding supervised claudication exercise therapy and pharmacotherapy; (b) receive comprehensive risk factor modification and antiplatelet therapy; (c) have a significant disability, either being unable to perform normal work or having serious impairment of other activities important to the patient; and (d) have

lower extremity PAD lesion anatomy such that the revascularization procedure would have low risk and a high probability of initial and long-term success. *(Level of Evidence: C)*

Class III

1. Arterial imaging is not indicated for patients with a normal postexercise ABI. This does not apply if other atherosclerotic causes (e.g., entrapment syndromes or isolated internal iliac artery occlusive disease) are suspected. *(Level of Evidence: C)*

Critical Limb Ischemia

Class I

1. Patients with clinical limb ischemia (CLI) should undergo expedited evaluation and treatment of factors that are known to increase the risk of amputation (see table below and discussion in the original guideline document). *(Level of Evidence: C)*
2. Patients with CLI in whom open surgical repair is anticipated should undergo assessment of cardiovascular risk. *(Level of Evidence: B)*
3. Patients with a prior history of CLI or who have undergone successful treatment for CLI should be evaluated at least twice annually by a vascular specialist owing to the relatively high incidence of recurrence. *(Level of Evidence: C)*
4. Patients at risk of CLI (ABI less than 0.4 in a nondiabetic individual, or any diabetic individual with known lower extremity PAD) should undergo regular inspection of the feet to detect objective signs of CLI. *(Level of Evidence: B)*
5. The feet should be examined directly, with shoes and socks removed, at regular intervals after successful treatment of CLI. *(Level of Evidence: C)*
6. Patients with CLI and features to suggest atheroembolization should be evaluated for aneurysmal disease (e.g., abdominal aortic, popliteal, or common femoral aneurysms). *(Level of Evidence: B)*
7. Systemic antibiotics should be initiated promptly in patients with CLI, skin ulcerations, and evidence of limb infection. *(Level of Evidence: B)*
8. Patients with CLI and skin breakdown should be referred to healthcare providers with specialized expertise in wound care. *(Level of Evidence: B)*
9. Patients at risk for CLI (those with diabetes, neuropathy, chronic renal failure, or infection) who develop acute limb symptoms represent potential vascular emergencies and should be assessed immediately and treated by a specialist competent in treating vascular disease. *(Level of Evidence: C)*
10. Patients at risk for or who have been treated for CLI should receive verbal and written instructions regarding self-surveillance for potential recurrence. *(Level of Evidence: C)*

Table: Factors That Increase Risk of Limb Loss in Patients with Critical Limb Ischemia

Factors that reduce blood flow to the microvascular bed: • Diabetes • Severe renal failure • Severely decreased cardiac output (severe heart failure or shock) • Vasospastic diseases or concomitant conditions (e.g., Raynaud's phenomenon, prolonged cold exposure) • Smoking and tobacco use
Factors that increase demand for blood flow to the microvascular bed: • Infection (e.g., cellulitis, osteomyelitis) • Skin breakdown or traumatic injury

Acute Limb Ischemia

Class I

1. Patients with acute limb ischemia and a salvageable extremity should undergo an emergent evaluation that defines the anatomic level of occlusion and that leads to prompt endovascular or surgical revascularization. *(Level of Evidence: B)*

Class III

1. Patients with acute limb ischemia and a nonviable extremity should not undergo an evaluation to define vascular anatomy or efforts to attempt revascularization. *(Level of Evidence: B)*

Prior Limb Arterial Revascularization

Class I

1. Long-term patency of infrainguinal bypass grafts should be evaluated in a surveillance program, which should include an interval vascular history, resting ABIs, physical examination, and a duplex ultrasound at regular intervals if a venous conduit has been used. *(Level of Evidence: B)*

Class IIa

1. Long-term patency of infrainguinal bypass grafts may be considered for evaluation in a surveillance program, which may include conducting exercise ABIs and other arterial imaging studies at regular intervals (see "Duplex Ultrasound" recommendations below). *(Level of Evidence: B)*
2. Long-term patency of endovascular sites may be evaluated in a surveillance program, which may include conducting exercise ABIs and other arterial imaging studies at regular intervals (see "Duplex Ultrasound" recommendations below). *(Level of Evidence: B)*

Diagnostic Methods

Ankle- and Toe-Brachial Indices, Segmental Pressure Examination (2011 Focused Update)

Class I

1. The resting ABI should be used to establish the lower extremity PAD diagnosis in patients with suspected lower extremity PAD, defined as individuals with 1 or more of the following: exertional leg symptoms, nonhealing wounds, age 65 years and older, or 50 years and older with a history of smoking or diabetes. *(Level of Evidence: B)* (Modified recommendation [age modified and level of evidence changed from C to B].)
2. The ABI should be measured in both legs in all new patients with PAD of any severity to confirm the diagnosis of lower extremity PAD and establish a baseline. *(Level of Evidence: B)* (2005 recommendation remains current in 2011 focused update.)
3. The toe-brachial index should be used to establish the lower extremity PAD diagnosis in patients in whom lower extremity PAD is clinically suspected but in whom the ABI test is not reliable due to noncompressible vessels (usually patients with long-standing diabetes or advanced age). *(Level of Evidence: B)* (2005 recommendation remains current in 2011 focused update.)
4. Leg segmental pressure measurements are useful to establish the lower extremity PAD diagnosis when anatomic localization of lower extremity PAD is required to create a therapeutic plan. *(Level of Evidence: B)* (2005 recommendation remains current in 2011 focused update.)
5. ABI results should be uniformly reported with noncompressible values defined as greater than 1.40, normal values 1.00 to 1.40, borderline 0.91 to 0.99, and abnormal 0.90 or less. *(Level of Evidence: B)* (New recommendation)

Pulse Volume Recording

Class IIa

1. Pulse volume recordings are reasonable to establish the initial lower extremity PAD diagnosis, assess localization and severity, and follow the status of lower extremity revascularization procedures. *(Level of Evidence: B)*

Continuous-Wave Doppler Ultrasound

Class I

1. Continuous-wave Doppler ultrasound blood flow measurements are useful to provide an accurate assessment of lower extremity PAD location and severity, to follow lower extremity PAD progression, and to provide quantitative follow-up after revascularization procedures. *(Level of Evidence: B)*

Treadmill Exercise Testing With and Without ABI Assessments and 6-Minute Walk Test

Class I

1. Exercise treadmill tests are recommended to provide the most objective evidence of the magnitude of the functional limitation of claudication and to measure the response to therapy. *(Level of Evidence: B)*
2. A standardized exercise protocol (either fixed or graded) with a motorized treadmill should be used to ensure reproducibility of measurements of pain-free walking distance and maximal walking distance. *(Level of Evidence: B)*
3. Exercise treadmill tests with measurement of preexercise and postexercise ABI values are recommended to provide diagnostic data useful in differentiating arterial claudication from nonarterial claudication ("pseudoclaudication"). *(Level of Evidence: B)*
4. Exercise treadmill tests should be performed in individuals with claudication who are to undergo exercise training (lower extremity PAD rehabilitation) so as to determine functional capacity, assess nonvascular exercise limitations, and demonstrate the safety of exercise. *(Level of Evidence: B)*

Class IIb

1. A 6-minute walk test may be reasonable to provide an objective assessment of the functional limitation of claudication and response to therapy in elderly individuals or others not amenable to treadmill testing. *(Level of Evidence: B)*

Duplex Ultrasound

Class I

1. Duplex ultrasound of the extremities is useful to diagnose anatomic location and degree of stenosis of PAD. *(Level of Evidence: A)*
2. Duplex ultrasound is recommended for routine surveillance after femoral-popliteal or femoral-tibial-pedal bypass with a venous conduit. Minimum surveillance intervals are approximately 3, 6, and 12 months, and then yearly after graft placement. *(Level of Evidence: A)*

Class II

1. Duplex ultrasound of the extremities can be useful to select patients as candidates for endovascular intervention. *(Level of Evidence: B)*
2. Duplex ultrasound can be useful to select patients as candidates for surgical bypass and to select the sites of surgical anastomosis. *(Level of Evidence: B)*

Class IIb

1. The use of duplex ultrasound is not well established to assess long-term patency of percutaneous transluminal angioplasty. *(Level of Evidence: B)*
2. Duplex ultrasound may be considered for routine surveillance after femoral-popliteal bypass with a synthetic conduit. *(Level of Evidence: B)*

Computed Tomographic Angiography

Class IIb

1. Computed tomographic angiography (CTA) of the extremities may be considered to diagnose anatomic location and presence of significant stenosis in patients with lower extremity PAD. *(Level of Evidence: B)*
2. CTA of the extremities may be considered as a substitute for magnetic resonance angiography (MRA) for those patients with contraindications to MRA. *(Level of Evidence: B)*

Magnetic Resonance Angiography

Class I

1. MRA of the extremities is useful to diagnose anatomic location and degree of stenosis of PAD. *(Level of Evidence: A)*
2. MRA of the extremities should be performed with gadolinium enhancement. *(Level of Evidence: B)*
3. MRA of the extremities is useful in selecting patients with lower extremity PAD as candidates for endovascular intervention. *(Level of Evidence: A)*

Class IIb

1. MRA of the extremities may be considered to select patients with lower extremity PAD as candidates for surgical bypass and to select the sites of surgical anastomosis. *(Level of Evidence: B)*
2. MRA of the extremities may be considered for postrevascularization (endovascular and surgical bypass) surveillance in patients with lower extremity PAD. *(Level of Evidence: B)*

Contrast Angiography

Class I

1. Contrast angiography provides detailed information about arterial anatomy and is recommended for evaluation of patients with lower extremity PAD when revascularization is contemplated. *(Level of Evidence: B)*
2. A history of contrast reaction should be documented before the performance of contrast angiography and appropriate pretreatment administered before contrast is given. *(Level of Evidence: B)*
3. Decisions regarding the potential utility of invasive therapeutic interventions (percutaneous or surgical) in patients with lower extremity PAD should be made with a complete anatomic assessment of the affected arterial territory, including imaging of the occlusive lesion, as well as arterial inflow and outflow with angiography or a combination of angiography and noninvasive vascular techniques. *(Level of Evidence: B)*
4. Digital subtraction angiography is recommended for contrast angiographic studies because this technique allows for enhanced imaging capabilities compared with conventional unsubtracted contrast angiography. *(Level of Evidence: A)*
5. Before performance of contrast angiography, a full history and complete vascular examination should be performed to optimize decisions regarding the access site, as well as to minimize contrast dose and catheter manipulation. *(Level of Evidence: C)*
6. Selective or superselective catheter placement during lower extremity angiography is indicated because this can enhance imaging, reduce contrast dose, and improve sensitivity and specificity of the procedure. *(Level of Evidence: C)*
7. The diagnostic lower extremity arteriogram should image the iliac, femoral, and tibial bifurcations in profile without vessel overlap. *(Level of Evidence: B)*
8. When conducting a diagnostic lower extremity arteriogram in which the significance of an obstructive lesion is ambiguous, transstenotic pressure gradients and supplementary angulated views should be obtained. *(Level of Evidence: B)*
9. Patients with baseline renal insufficiency should receive hydration before undergoing contrast angiography. *(Level of Evidence: B)*
10. Follow-up clinical evaluation, including a physical examination and measurement of renal function, is recommended within 2 weeks after contrast angiography to detect the presence of delayed adverse effects, such as atheroembolism, deterioration in renal function, or access site injury (e.g., pseudoaneurysm or arteriovenous fistula). *(Level of Evidence: C)*

Class IIa

1. Noninvasive imaging modalities, including MRA, CTA, and color flow duplex imaging, may be used in advance of invasive imaging to develop an

individualized diagnostic strategic plan, including assistance in selection of access sites, identification of significant lesions, and determination of the need for invasive evaluation. *(Level of Evidence: B)*
2. Treatment with *n*-acetylcysteine in advance of contrast angiography is suggested for patients with baseline renal insufficiency (creatinine greater than 2.0 mg per dL). *(Level of Evidence: B)*

Treatment

Cardiovascular Risk Reduction

Lipid-Lowering Drugs

Class I

1. Treatment with a hydroxymethylglutaryl (HMG) coenzyme-A reductase inhibitor (statin) medication is indicated for all patients with PAD to achieve a target low-density lipoprotein (LDL) cholesterol level of less than 100 mg per dL. *(Level of Evidence: B)*

Class IIa

1. Treatment with an HMG coenzyme-A reductase inhibitor (statin) medication to achieve a target LDL cholesterol level of less than 70 mg per dL is reasonable for patients with lower extremity PAD at very high risk of ischemic events. *(Level of Evidence: B)*
2. Treatment with a fibric acid derivative can be useful for patients with PAD and low high-density lipoprotein (HDL) cholesterol, normal LDL cholesterol, and elevated triglycerides. *(Level of Evidence: C)*

Antihypertensive Drugs

Class I

1. Antihypertensive therapy should be administered to hypertensive patients with lower extremity PAD to achieve a goal of less than 140 mm Hg systolic over 90 mm Hg diastolic (nondiabetics) or less than 130 mm Hg systolic over 80 mm Hg diastolic (diabetics and individuals with chronic renal disease) to reduce the risk of MI, stroke, congestive heart failure, and cardiovascular death. *(Level of Evidence: A)*
2. Beta-adrenergic blocking drugs are effective antihypertensive agents and are not contraindicated in patients with PAD. *(Level of Evidence: A)*

Class IIa

1. The use of angiotensin-converting enzyme (ACE) inhibitors is reasonable for symptomatic patients with lower extremity PAD to reduce the risk of adverse cardiovascular events. *(Level of Evidence: B)*

Class IIb

1. Angiotensin-converting enzyme inhibitors may be considered for patients with asymptomatic lower extremity PAD to reduce the risk of adverse cardiovascular events. *(Level of Evidence: C)*

Diabetes Therapies

Class I

1. Proper foot care, including use of appropriate footwear, chiropody/podiatric medicine, daily foot inspection, skin cleansing, and use of topical moisturizing creams, should be encouraged and skin lesions and ulcerations should be addressed urgently in all diabetic patients with lower extremity PAD. *(Level of Evidence: B)*

Class IIa

1. Treatment of diabetes in individuals with lower extremity PAD by administration of glucose control therapies to reduce the hemoglobin A_{1C} to less than 7% can be effective to reduce microvascular complications and potentially improve cardiovascular outcomes. *(Level of Evidence: C)*

Smoking Cessation (2011 Focused Update)

Class I

1. Patients who are smokers or former smokers should be asked about status of tobacco use at every visit. *(Level of Evidence: A)* (New recommendation)
2. Patients should be assisted with counseling and developing a plan for quitting that may include pharmacotherapy and/or referral to a smoking cessation program. *(Level of Evidence: A)* (New recommendation)
3. Individuals with lower extremity PAD who smoke cigarettes or use other forms of tobacco should be advised by each of their clinicians to stop smoking and offered behavioral and pharmacological treatment. *(Level of Evidence: C)* (Modified recommendation [wording clarified and level of evidence changed from B to C].)

4. In the absence of contraindication or other compelling clinical indication, 1 or more of the following pharmacological therapies should be offered: varenicline, bupropion, and nicotine replacement therapy. *(Level of Evidence: A)* (New recommendation)

Homocysteine-Lowering Drugs

Class IIb

1. The effectiveness of the therapeutic use of folic acid and B_{12} vitamin supplements in individuals with lower extremity PAD and homocysteine levels greater than 14 micromoles per liter is not well established. *(Level of Evidence: C)*

Antiplatelet and Antithrombotic Drugs (2011 Focused Update)

Class I

1. Antiplatelet therapy is indicated to reduce the risk of MI, stroke, and vascular death in individuals with symptomatic atherosclerotic lower extremity PAD, including those with intermittent claudication or critical limb ischemia, prior lower extremity revascularization (endovascular or surgical), or prior amputation for lower extremity ischemia. *(Level of Evidence: A)* (Modified recommendation [wording clarified].)
2. Aspirin, typically in daily doses of 75 to 325 mg, is recommended as safe and effective antiplatelet therapy to reduce the risk of MI, stroke, or vascular death in individuals with symptomatic atherosclerotic lower extremity PAD, including those with intermittent claudication or critical limb ischemia, prior lower extremity revascularization (endovascular or surgical), or prior amputation for lower extremity ischemia. *(Level of Evidence: B)* (Modified recommendation [wording clarified; level of evidence changed from A to B].)
3. Clopidogrel (75 mg per day) is recommended as a safe and effective alternative antiplatelet therapy to aspirin to reduce the risk of MI, ischemic stroke, or vascular death in individuals with symptomatic atherosclerotic lower extremity PAD, including those with intermittent claudication or critical limb ischemia, prior lower extremity revascularization (endovascular or surgical), or prior amputation for lower extremity ischemia. *(Level of Evidence: B)* (Modified recommendation [wording clarified].)

Class IIa

1. Antiplatelet therapy can be useful to reduce the risk of MI, stroke, or vascular death in asymptomatic individuals with an ABI less than or equal to 0.90. *(Level of Evidence: C)* (New recommendation)

Class IIb

1. The usefulness of antiplatelet therapy to reduce the risk of MI, stroke, or vascular death in asymptomatic individuals with borderline abnormal ABI, defined as 0.91 to 0.99, is not well established. *(Level of Evidence: A)* (New recommendation)
2. The combination of aspirin and clopidogrel may be considered to reduce the risk of cardiovascular events in patients with symptomatic atherosclerotic lower extremity PAD, including those with intermittent claudication or critical limb ischemia, prior lower extremity revascularization (endovascular or surgical), or prior amputation for lower extremity ischemia and who are not at increased risk of bleeding and who are at high perceived cardiovascular risk. *(Level of Evidence: B)* (New recommendation)

Class III

1. In the absence of any other proven indication for warfarin, its addition to antiplatelet therapy to reduce the risk of adverse cardiovascular ischemic events in individuals with atherosclerotic lower extremity PAD is of no benefit and is potentially harmful due to increased risk of major bleeding. *(Level of Evidence: B)* (Modified recommendation [level of evidence changed from C to B].)

Claudication

Exercise and Lower Extremity PAD Rehabilitation

Class I

1. A program of supervised exercise training is recommended as an initial treatment modality for patients with intermittent claudication. *(Level of Evidence: A)*
2. Supervised exercise training should be performed for a minimum of 30 to 45 minutes, in sessions performed at least 3 times per week for a minimum of 12 weeks. *(Level of Evidence: A)*

Class IIb

1. The usefulness of unsupervised exercise programs is not well established as an effective initial treatment modality for patients with intermittent claudication. *(Level of Evidence: B)*

Medical and Pharmacological Treatment for Claudication

- Cilostazol

Class I

1. Cilostazol (100 mg orally 2 times per day) is indicated as an effective therapy to improve symptoms and increase walking distance in patients with lower extremity PAD and intermittent claudication (in the absence of heart failure). *(Level of Evidence: A)*
2. A therapeutic trial of cilostazol should be considered in all patients with lifestyle-limiting claudication (in the absence of heart failure). *(Level of Evidence: A)*

- Pentoxifylline
  Class IIb

1. Pentoxifylline (400 mg 3 times per day) may be considered as second-line alternative therapy to cilostazol to improve walking distance in patients with intermittent claudication. *(Level of Evidence: A)*
2. The clinical effectiveness of pentoxifylline as therapy for claudication is marginal and not well established. *(Level of Evidence: C)*

- Other proposed medical therapies
  Class IIb

1. The effectiveness of L-arginine for patients with intermittent claudication is not well established. *(Level of Evidence: B)*
2. The effectiveness of propionyl-L-carnitine as a therapy to improve walking distance in patients with intermittent claudication is not well established. *(Level of Evidence: B)*
3. The effectiveness of ginkgo biloba to improve walking distance for patients with intermittent claudication is marginal and not well established. *(Level of Evidence: B)*

Class III

1. Oral vasodilator prostaglandins such as beraprost and iloprost are not effective medications to improve walking distance in patients with intermittent claudication. *(Level of Evidence: A)*
2. Vitamin E is not recommended as a treatment for patients with intermittent claudication. *(Level of Evidence: C)*
3. Chelation (e.g., ethylenediaminetetraacetic acid) is not indicated for treatment of intermittent claudication and may have harmful adverse effects. *(Level of Evidence: A)*

Endovascular Treatment for Claudication

Class I

1. Endovascular procedures are indicated for individuals with a vocational or lifestyle-limiting disability due to intermittent claudication when clinical features suggest a reasonable likelihood of symptomatic improvement with endovascular intervention and (a) there has been an inadequate response to exercise or pharmacological therapy and/or (b) there is a very favorable risk-benefit ratio (e.g., focal aortoiliac occlusive disease). *(Level of Evidence: A)*
2. Endovascular intervention is recommended as the preferred revascularization technique for TransAtlantic Inter-Society Consensus (TASC) type A (see Tables 20 and 21 and Figure 8 in the original guideline document) iliac and femoropopliteal arterial lesions. *(Level of Evidence: B)*
3. Translesional pressure gradients (with and without vasodilation) should be obtained to evaluate the significance of angiographic iliac arterial stenoses of 50% to 75% diameter before intervention. *(Level of Evidence: C)*
4. Provisional stent placement is indicated for use in the iliac arteries as salvage therapy for a suboptimal or failed result from balloon dilation (e.g., persistent translesional gradient, residual diameter stenosis greater than 50%, or flow-limiting dissection). *(Level of Evidence: B)*
5. Stenting is effective as primary therapy for common iliac artery stenosis and occlusions. *(Level of Evidence: B)*
6. Stenting is effective as primary therapy in external iliac artery stenoses and occlusions. *(Level of Evidence: C)*

Class IIa

1. Stents (and other adjunctive techniques such as lasers, cutting balloons, atherectomy devices, and thermal devices) can be useful in the femoral, popliteal, and tibial arteries as salvage therapy for a suboptimal or failed result from balloon dilation (e.g., persistent translesional gradient, residual diameter stenosis greater than 50%, or flow-limiting dissection). *(Level of Evidence: C)*

Class IIb

1. The effectiveness of stents, atherectomy, cutting balloons, thermal devices, and lasers for the treatment of femoral-popliteal arterial lesions (except to salvage a suboptimal result from balloon dilation) is not well established. *(Level of Evidence: A)*
2. The effectiveness of uncoated/uncovered stents, atherectomy, cutting balloons, thermal devices, and lasers for the treatment of infrapopliteal lesions (except to salvage a suboptimal result from balloon dilation) is not well established. *(Level of Evidence: C)*

Class III

1. Endovascular intervention is not indicated if there is no significant pressure gradient across a stenosis despite flow augmentation with vasodilators. *(Level of Evidence: C)*
2. Primary stent placement is not recommended in the femoral, popliteal, or tibial arteries. *(Level of Evidence: C)*
3. Endovascular intervention is not indicated as prophylactic therapy in an asymptomatic patient with lower extremity PAD. *(Level of Evidence: C)*

Surgery for Claudication

- Indications
  Class I

  1. Surgical interventions are indicated for individuals with claudication symptoms who have a significant functional disability that is vocational or lifestyle limiting, who are unresponsive to exercise or pharmacotherapy, and who have a reasonable likelihood of symptomatic improvement. *(Level of Evidence: B)*

  Class IIb

  1. Because the presence of more aggressive atherosclerotic occlusive disease is associated with less durable results in patients younger than 50 years of age, the effectiveness of surgical intervention in this population for intermittent claudication is unclear. *(Level of Evidence: B)*

  Class III

  1. Surgical intervention is not indicated to prevent progression to limb-threatening ischemia in patients with intermittent claudication. *(Level of Evidence: B)*
- Preoperative Evaluation
  Class I

  1. A preoperative cardiovascular risk evaluation should be undertaken in those patients with lower extremity PAD in whom a major vascular surgical intervention is planned. *(Level of Evidence: B)*
- Inflow Procedures: Aortoiliac Occlusive Disease
  Class I

  1. Aortobifemoral bypass is beneficial for patients with vocational- or lifestyle-disabling symptoms and hemodynamically significant aortoiliac disease who are acceptable surgical candidates and who are unresponsive to or unsuitable for exercise, pharmacotherapy, or endovascular repair. *(Level of Evidence: B)*
  2. Iliac endarterectomy and aortoiliac or iliofemoral bypass in the setting of acceptable aortic inflow should be used for the surgical treatment of unilateral disease or in conjunction with femoral-femoral bypass for the treatment of a patient with bilateral iliac artery occlusive disease if the patient is not a suitable candidate for aortobifemoral bypass grafting. *(Level of Evidence: B)*

  Class IIb

  1. Axillofemoral-femoral bypass may be considered for the surgical treatment of patients with intermittent claudication in very limited settings, such as chronic infrarenal aortic occlusion associated with symptoms of severe claudication in patients who are not candidates for aortobifemoral bypass. *(Level of Evidence: B)*

  Class III

  1. Axillofemoral-femoral bypass should not be used for the surgical treatment of patients with intermittent claudication except in very limited settings (see Class IIb recommendation above). *(Level of Evidence: B)*
- Outflow Procedures: Infrainguinal Disease
  Class I

  1. Bypasses to the popliteal artery above the knee should be constructed with autogenous vein when possible. *(Level of Evidence: A)*
  2. Bypasses to the popliteal artery below the knee should be constructed with autogenous vein when possible. *(Level of Evidence: B)*

  Class IIa

  1. The use of synthetic grafts to the popliteal artery below the knee is reasonable only when no autogenous vein from ipsilateral or contralateral leg or arms is available. *(Level of Evidence: A)*

  Class IIb

  1. Femoral-tibial artery bypasses constructed with autogenous vein may be considered for the treatment of claudication in rare instances for certain patients (see the original guideline document). *(Level of Evidence: B)*
  2. Because their use is associated with reduced patency rates, the effectiveness of the use of synthetic grafts to the popliteal artery above the knee is not well-established. *(Level of Evidence: B)*

  Class III

  1. Femoral-tibial artery bypasses with synthetic graft material should not be used for the treatment of claudication. *(Level of Evidence: C)*
- Follow-Up after Vascular Surgical Procedures
  Class I

  1. Patients who have undergone placement of aortobifemoral bypass grafts should be followed up with periodic evaluations that record any return or progression of claudication symptoms, the presence of femoral pulses, and ABIs at rest and after exercise. *(Level of Evidence: C)*
  2. Patients who have undergone placement of a lower extremity bypass with autogenous vein should undergo periodic evaluations for at least 2 years that record any claudication symptoms; a physical examination and pulse examination of the proximal, graft, and outflow vessels; and duplex

imaging of the entire length of the graft, with measurement of peak systolic velocities and calculation of velocity ratios across all lesions. *(Level of Evidence: C)*

3. Patients who have undergone placement of a synthetic lower extremity bypass graft should, for at least 2 years after implantation, undergo periodic evaluations that record any return or progression of claudication symptoms; a pulse examination of the proximal, graft, and outflow vessels; and assessment of ABIs at rest and after exercise. *(Level of Evidence: C)*

Clinical Limb Ischemia and Treatment for Limb Salvage

Medical and Pharmacological Treatment for Critical Limb Ischemia (CLI)

Class III

1. Parenteral administration of pentoxifylline is not useful for the treatment of CLI. *(Level of Evidence: B)*

- Prostaglandins
  Class IIb

  1. Parenteral administration of PGE-1 or iloprost for 7 to 28 days may be considered to reduce ischemic pain and facilitate ulcer healing in patients with CLI, but its efficacy is likely to be limited to a small percentage of patients. *(Level of Evidence: A)*

  Class III

  1. Oral iloprost is not an effective therapy to reduce the risk of amputation or death in patients with CLI. *(Level of Evidence: B)*
- Angiogenic Growth Factors
  Class IIb

  1. The efficacy of angiogenic growth factor therapy for treatment of CLI is not well established and is best investigated in the context of a placebo-controlled trial. *(Level of Evidence: C)*

Endovascular Treatment for CLI (2011 Focused Update)

Class I

1. For individuals with combined inflow and outflow disease with CLI, inflow lesions should be addressed first. *(Level of Evidence: C)* (2005 recommendation remains current in 2011 focused update.)
2. For individuals with combined inflow and outflow disease in whom symptoms of CLI or infection persist after inflow revascularization, an outflow revascularization procedure should be performed. *(Level of Evidence: B)* (2005 recommendation remains current in 2011 focused update.)
3. If it is unclear whether hemodynamically significant inflow disease exists, intra-arterial pressure measurements across suprainguinal lesions should be measured before and after the administration of a vasodilator. *(Level of Evidence: C)* (2005 recommendation remains current in 2011 focused update.)

Class IIa

1. For patients with limb-threatening lower extremity ischemia and an estimated life expectancy of 2 years or less or in patients in whom an autogenous vein conduit is not available, balloon angioplasty is reasonable to perform when possible as the initial procedure to improve distal blood flow. *(Level of Evidence: B)* (New recommendation)
2. For patients with limb-threatening ischemia and an estimated life expectancy of more than 2 years, bypass surgery, when possible and when an autogenous vein conduit is available, is reasonable to perform as the initial treatment to improve distal blood flow. *(Level of Evidence: B)* (New recommendation)

Thrombolysis for Acute and Chronic Limb Ischemia

Class I

1. Catheter-based thrombolysis is an effective and beneficial therapy and is indicated for patients with acute limb ischemia (Rutherford categories I and IIa) of less than 14 days' duration. *(Level of Evidence: A)*

Class IIa

1. Mechanical thrombectomy devices can be used as adjunctive therapy for acute limb ischemia due to peripheral arterial occlusion. *(Level of Evidence: B)*

Class IIb

1. Catheter-based thrombolysis or thrombectomy may be considered for patients with acute limb ischemia (Rutherford category IIb) of more than 14 days' duration. *(Level of Evidence: B)*

Surgery for CLI

Class I

1. For individuals with combined inflow and outflow disease with CLI, inflow lesions should be addressed first. *(Level of Evidence: B)*
2. For individuals with combined inflow and outflow disease in whom symptoms of CLI or infection persist after inflow revascularization, an outflow revascularization procedure should be performed. *(Level of Evidence: B)*
3. Patients who have significant necrosis of the weight-bearing portions of the foot (in ambulatory patients), an uncorrectable flexion contracture, paresis of the extremity, refractory ischemic rest pain, sepsis, or a very limited life expectancy due to comorbid conditions should be evaluated for primary amputation of the leg. *(Level of Evidence: C)*

Class III

1. Surgical and endovascular intervention is not indicated in patients with severe decrements in limb perfusion (e.g., ABI less than 0.4) in the absence of clinical symptoms of CLI. *(Level of Evidence: C)*

- Inflow Procedures: Aortoiliac Occlusive Disease
  Class I

  1. When surgery is to be undertaken, aortobifemoral bypass is recommended for patients with symptomatic, hemodynamically significant, aorto-bi-iliac disease requiring intervention. *(Level of Evidence: A)*
  2. Iliac endarterectomy, patch angioplasty, or aortoiliac or iliofemoral bypass in the setting of acceptable aortic inflow should be used for the treatment of unilateral disease or in conjunction with femoral-femoral bypass for the treatment of a patient with bilateral iliac artery occlusive disease if the patient is not a suitable candidate for aortobifemoral bypass grafting. *(Level of Evidence: B)*
  3. Axillofemoral-femoral bypass is indicated for the treatment of patients with CLI who have extensive aortoiliac disease and are not candidates for other types of intervention. *(Level of Evidence: B)*
- Outflow Procedures: Infrainguinal Disease
  Class I

  1. Bypasses to the above-knee popliteal artery should be constructed with autogenous saphenous vein when possible. *(Level of Evidence: A)*
  2. Bypasses to the below-knee popliteal artery should be constructed with autogenous vein when possible. *(Level of Evidence: A)*
  3. The most distal artery with continuous flow from above and without a stenosis greater than 20% should be used as the point of origin for a distal bypass. *(Level of Evidence: B)*
  4. The tibial or pedal artery that is capable of providing continuous and uncompromised outflow to the foot should be used as the site of distal anastomosis. *(Level of Evidence: B)*
  5. Femoral-tibial artery bypasses should be constructed with autogenous vein, including the ipsilateral greater saphenous vein, or if unavailable, other sources of vein from the leg or arm. *(Level of Evidence: B)*
  6. Composite sequential femoropopliteal-tibial bypass and bypass to an isolated popliteal arterial segment that has collateral outflow to the foot are both acceptable methods of revascularization and should be considered when no other form of bypass with adequate autogenous conduit is possible. *(Level of Evidence: B)*
  7. If no autogenous vein is available, a prosthetic femoral-tibial bypass, and possibly an adjunctive procedure, such as arteriovenous fistula or vein interposition or cuff, should be used when amputation is imminent. *(Level of Evidence: B)*

  Class IIa

  1. Prosthetic material can be used effectively for bypasses to the below-knee popliteal artery when no autogenous vein from ipsilateral or contralateral leg or arms is available. *(Level of Evidence: B)*
- Postsurgical Care
  Class I

  1. Unless contraindicated, all patients undergoing revascularization for CLI should be placed on antiplatelet therapy (see Sections 2.4.2 and 2.6.1.6 of the original guideline document), and this treatment should be continued indefinitely. *(Level of Evidence: A)*
  2. Patients who have undergone placement of aortobifemoral bypass grafts should be followed up with periodic evaluations that record any return or progression of ischemic symptoms, the presence of femoral pulses, and ABIs. *(Level of Evidence: B)*
  3. If infection, ischemic ulcers, or gangrenous lesions persist and the ABI is less than 0.8 after correction of inflow, an outflow procedure should be performed that bypasses all major distal stenoses and occlusions. *(Level of Evidence: A)*
  4. Patients who have undergone placement of a lower extremity bypass with autogenous vein should undergo for at least 2 years periodic examinations that record any return or progression of ischemic symptoms; a physical examination, with concentration on pulse examination of the proximal, graft, and outflow vessels; and duplex imaging of the entire length of the graft, with measurement of peak systolic velocities and calculation of velocity ratios across all lesions. *(Level of Evidence: A)*
  5. Patients who have undergone placement of a synthetic lower extremity bypass graft should undergo periodic examinations that record any return of ischemic symptoms; a pulse examination of the proximal, graft, and outflow vessels; and assessment of ABIs at rest and after exercise for at least 2 years after implantation. *(Level of Evidence: A)*

Renal Arterial Disease (RAS)

Clinical Clues to the Diagnosis of RAS

Class I

1. The performance of diagnostic studies to identify clinically significant RAS is indicated in patients with the onset of hypertension before the age of 30 years. *(Level of Evidence: B)*
2. The performance of diagnostic studies to identify clinically significant RAS is indicated in patients with the onset of severe hypertension (as defined in The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC-7 report) after the age of 55 years. *(Level of Evidence: B)*
3. The performance of diagnostic studies to identify clinically significant RAS is indicated in patients with the following characteristics: (a) accelerated hypertension (sudden and persistent worsening of previously controlled hypertension); (b) resistant hypertension (defined as the failure to achieve goal blood pressure in patients who are adhering to full doses of an appropriate 3-drug regimen that includes a diuretic); or (c) malignant hypertension (hypertension with coexistent evidence of acute end-organ damage, i.e., acute renal failure, acutely decompensated congestive heart failure, new visual or neurological disturbance, and/or advanced [grade III to IV] retinopathy). *(Level of Evidence: C)*
4. The performance of diagnostic studies to identify clinically significant RAS is indicated in patients with new azotemia or worsening renal function after the administration of an ACE inhibitor or an angiotensin receptor blocking agent (see the original guideline document). *(Level of Evidence: B)*
5. The performance of diagnostic studies to identify clinically significant RAS is indicated in patients with an unexplained atrophic kidney or a discrepancy in size between the 2 kidneys of greater than 1.5 cm. *(Level of Evidence: B)*
6. The performance of diagnostic studies to identify clinically significant RAS is indicated in patients with sudden, unexplained pulmonary edema (especially in azotemic patients). *(Level of Evidence: B)*

Class IIa

1. The performance of diagnostic studies to identify clinically significant RAS is reasonable in patients with unexplained renal failure, including individuals starting renal replacement therapy (dialysis or renal transplantation). *(Level of Evidence: B)*

Class IIb

1. The performance of arteriography to identify significant RAS may be reasonable in patients with multivessel coronary artery disease and none of the clinical clues (refer to Figure 17 in the original guideline document) or PAD at the time of arteriography. *(Level of Evidence: B)*
2. The performance of diagnostic studies to identify clinically significant RAS may be reasonable in patients with unexplained congestive heart failure or refractory angina (see Section 3.5.2.4 of the original guideline document). *(Level of Evidence: C)*

Diagnostic Methods

Class I

1. Duplex ultrasonography is recommended as a screening test to establish the diagnosis of RAS. *(Level of Evidence: B)*
2. Computed tomographic angiography (in individuals with normal renal function) is recommended as a screening test to establish the diagnosis of RAS. *(Level of Evidence: B)*
3. MRA is recommended as a screening test to establish the diagnosis of RAS. *(Level of Evidence: B)*
4. When the clinical index of suspicion is high and the results of noninvasive tests are inconclusive, catheter angiography is recommended as a diagnostic test to establish the diagnosis of RAS. *(Level of Evidence: B)*

Class III

1. Captopril renal scintigraphy is not recommended as a screening test to establish the diagnosis of RAS. *(Level of Evidence: C)*
2. Selective renal vein renin measurements are not recommended as a useful screening test to establish the diagnosis of RAS. *(Level of Evidence: B)*
3. Plasma renin activity is not recommended as a useful screening test to establish the diagnosis of RAS. *(Level of Evidence: B)*
4. The captopril test (measurement of plasma renin activity after captopril administration) is not recommended as a useful screening test to establish the diagnosis of RAS. *(Level of Evidence: B)*

Treatment of Renovascular Disease: Renal Artery Stenosis

Medical Treatment

Class I

1. Angiotensin-converting enzyme inhibitors are effective medications for treatment of hypertension associated with unilateral RAS. *(Level of Evidence: A)*
2. Angiotensin receptor blockers are effective medications for treatment of hypertension associated with unilateral RAS. *(Level of Evidence: B)*
3. Calcium-channel blockers are effective medications for treatment of hypertension associated with unilateral RAS. *(Level of Evidence: A)*
4. Beta-blockers are effective medications for treatment of hypertension associated with RAS. *(Level of Evidence: A)*

Indications for Revascularization

Asymptomatic Stenosis

Class IIb

1. Percutaneous revascularization may be considered for treatment of an asymptomatic bilateral or solitary viable kidney with a hemodynamically significant RAS. *(Level of Evidence: C)*
2. The usefulness of percutaneous revascularization of an asymptomatic unilateral hemodynamically significant RAS in a viable kidney is not well established and is presently clinically unproven. *(Level of Evidence: C)*

Hypertension

Class IIa

1. Percutaneous revascularization is reasonable for patients with hemodynamically significant RAS and accelerated hypertension, resistant hypertension, malignant hypertension, hypertension with an unexplained unilateral small kidney, and hypertension with intolerance to medication. *(Level of Evidence: B)*

Preservation of Renal Function

Class IIa

1. Percutaneous revascularization is reasonable for patients with RAS and progressive chronic kidney disease with bilateral RAS or a RAS to a solitary functioning kidney. *(Level of Evidence: B)*

Class IIb

1. Percutaneous revascularization may be considered for patients with RAS and chronic renal insufficiency with unilateral RAS. *(Level of Evidence: C)*

Impact of RAS on Congestive Heart Failure and Unstable Angina

Class I

1. Percutaneous revascularization is indicated for patients with hemodynamically significant RAS and recurrent, unexplained congestive heart failure or sudden, unexplained pulmonary edema (see the original guideline document). *(Level of Evidence: B)*

Class IIa

1. Percutaneous revascularization is reasonable for patients with hemodynamically significant RAS and unstable angina (see the original guideline document). *(Level of Evidence: B)*

Catheter-Based Interventions

Class I

1. Renal stent placement is indicated for ostial atherosclerotic RAS lesions that meet the clinical criteria for intervention. *(Level of Evidence: B)*
2. Balloon angioplasty with bailout stent placement if necessary is recommended for fibromuscular dysplasia (FMD) lesions. *(Level of Evidence: B)*

Surgery for RAS

Class I

1. Vascular surgical reconstruction is indicated for patients with fibromuscular dysplastic RAS with clinical indications for interventions (same as for percutaneous transluminal angioplasty [PTA]), especially those exhibiting complex disease that extends into the segmental arteries and those having macroaneurysms. *(Level of Evidence: B)*
2. Vascular surgical reconstruction is indicated for patients with atherosclerotic RAS and clinical indications for intervention, especially those with multiple small renal arteries or early primary branching of the main renal artery. *(Level of Evidence: B)*
3. Vascular surgical reconstruction is indicated for patients with atherosclerotic RAS in combination with pararenal aortic reconstructions (in treatment of aortic aneurysms or severe aortoiliac occlusive disease). *(Level of Evidence: C)*

Mesenteric Arterial Disease

Acute Intestinal Ischemia

Acute Intestinal Ischemia Caused by Arterial Obstruction

Diagnosis

Class I

1. Patients with acute abdominal pain out of proportion to physical findings and who have a history of cardiovascular disease should be suspected of having acute intestinal ischemia. *(Level of Evidence: B)*
2. Patients who develop acute abdominal pain after arterial interventions in which catheters traverse the visceral aorta or any proximal arteries or who have arrhythmias (such as atrial fibrillation) or recent MI should be suspected of having acute intestinal ischemia. *(Level of Evidence: C)*

Class III

1. In contrast to chronic intestinal ischemia, duplex sonography of the abdomen is not an appropriate diagnostic tool for suspected acute intestinal ischemia. *(Level of Evidence: C)*

Surgical Treatment

Class I

1. Surgical treatment of acute obstructive intestinal ischemia includes revascularization, resection of necrotic bowel, and, when appropriate, a "second look" operation 24 to 48 hours after the revascularization. *(Level of Evidence: B)*

Endovascular Treatment

Class IIb

1. Percutaneous interventions (including transcatheter lytic therapy, balloon angioplasty, and stenting) are appropriate in selected patients with acute intestinal ischemia caused by arterial obstructions. Patients so treated may still require laparotomy. *(Level of Evidence: C)*

Acute Nonocclusive Intestinal Ischemia

Etiology

Class I

1. Nonocclusive intestinal ischemia should be suspected in patients with low flow states or shock, especially cardiogenic shock, who develop abdominal pain. *(Level of Evidence: B)*
2. Nonocclusive intestinal ischemia should be suspected in patients receiving vasoconstrictor substances and medications (e.g., cocaine, ergots, vasopressin, or norepinephrine) who develop abdominal pain. *(Level of Evidence: B)*
3. Nonocclusive intestinal ischemia should be suspected in patients who develop abdominal pain after coarctation repair or after surgical revascularization for intestinal ischemia caused by arterial obstruction. *(Level of Evidence: B)*

Diagnosis

Class I

1. Arteriography is indicated in patients suspected of having nonocclusive intestinal ischemia whose condition does not improve rapidly with treatment of their underlying disease. *(Level of Evidence: B)*

Treatment

Class I

1. Treatment of the underlying shock state is the most important initial step in treatment of nonocclusive intestinal ischemia. *(Level of Evidence: C)*
2. Laparotomy and resection of nonviable bowel is indicated in patients with nonocclusive intestinal ischemia who have persistent symptoms despite treatment. *(Level of Evidence: B)*

Class IIa

1. Transcatheter administration of vasodilator medications into the area of vasospasm is indicated in patients with nonocclusive intestinal ischemia who do not respond to systemic supportive treatment and in patients with intestinal ischemia due to cocaine or ergot poisoning. *(Level of Evidence: B)*

Chronic Intestinal Ischemia

Diagnosis

Class I

1. Chronic intestinal ischemia should be suspected in patients with abdominal pain and weight loss without other explanation, especially those with cardiovascular disease. *(Level of Evidence: B)*
2. Duplex ultrasound, CTA, and gadolinium-enhanced MRA are useful initial tests for supporting the clinical diagnosis of chronic intestinal ischemia. *(Level of Evidence: B)*

3. Diagnostic angiography, including lateral aortography, should be obtained in patients suspected of having chronic intestinal ischemia for whom noninvasive imaging is unavailable or indeterminate. *(Level of Evidence: B)*

Interventional Treatment

Class I

1. Percutaneous endovascular treatment of intestinal arterial stenosis is indicated in patients with chronic intestinal ischemia. *(Level of Evidence: B)*

Surgical Treatment

Class I

1. Surgical treatment of chronic intestinal ischemia is indicated in patients with chronic intestinal ischemia. *(Level of Evidence: B)*

Class IIb

1. Revascularization of asymptomatic intestinal arterial obstructions may be considered for patients undergoing aortic/renal artery surgery for other indications. *(Level of Evidence: B)*

Class III

1. Surgical revascularization is not indicated for patients with asymptomatic intestinal arterial obstructions, except in patients undergoing aortic/renal artery surgery for other indications. *(Level of Evidence: B)*

Aneurysms of the Abdominal Aorta, Its Branch Vessels, and the Lower Extremities

Abdominal Aortic and Iliac Aneurysms

Etiology

Atherosclerotic Risk Factors

Class I

1. In patients with abdominal aortic aneurysms (AAAs), blood pressure and fasting serum lipid values should be monitored and controlled as recommended for patients with atherosclerotic disease. *(Level of Evidence: C)*
2. Patients with aneurysms or a family history of aneurysms should be advised to stop smoking and be offered smoking cessation interventions, including behavior modification, nicotine replacement, or bupropion. *(Level of Evidence: B)*

Natural History

Aortic Aneurysm Rupture

Class I

1. Patients with infrarenal or juxtarenal AAAs measuring 5.5 cm or larger should undergo repair to eliminate the risk of rupture. *(Level of Evidence: B)*
2. Patients with infrarenal or juxtarenal AAAs measuring 4.0 to 5.4 cm in diameter should be monitored by ultrasound or computed tomographic scans every 6 to 12 months to detect expansion. *(Level of Evidence: A)*

Class IIa

1. Repair can be beneficial in patients with infrarenal or juxtarenal AAAs 5.0 to 5.4 cm in diameter. *(Level of Evidence: B)*
2. Repair is probably indicated in patients with suprarenal or type IV thoracoabdominal aortic aneurysms larger than 5.5 to 6.0 cm. *(Level of Evidence: B)*
3. In patients with AAAs smaller than 4.0 cm in diameter, monitoring by ultrasound examination every 2 to 3 years is reasonable. *(Level of Evidence: B)*

Class III

1. Intervention is not recommended for asymptomatic infrarenal or juxtarenal AAAs if they measure less than 5.0 cm in diameter in men or less than 4.5 cm in diameter in women. *(Level of Evidence: A)*

Diagnosis

Symptomatic Aortic or Iliac Aneurysms

Class I

1. In patients with the clinical triad of abdominal and/or back pain, a pulsatile abdominal mass, and hypotension, immediate surgical evaluation is indicated. *(Level of Evidence: B)*

2. In patients with symptomatic aortic aneurysms, repair is indicated regardless of diameter. *(Level of Evidence: C)*

Screening High-Risk Populations

Class I

1. Men 60 years of age or older who are either the siblings or offspring of patients with AAAs should undergo physical examination and ultrasound screening for detection of aortic aneurysms. *(Level of Evidence: B)*

Class IIa

1. Men who are 65 to 75 years of age who have ever smoked should undergo a physical examination and 1-time ultrasound screening for detection of AAAs. *(Level of Evidence: B)*

Observational Management

Blood Pressure Control and Beta-Blockade

Class I

1. Perioperative administration of beta-adrenergic blocking agents, in the absence of contraindications, is indicated to reduce the risk of adverse cardiac events and mortality in patients with coronary artery disease undergoing surgical repair of atherosclerotic aortic aneurysms. *(Level of Evidence: A)*

Class IIb

1. Beta-adrenergic blocking agents may be considered to reduce the rate of aneurysm expansion in patients with aortic aneurysms. *(Level of Evidence: B)*

Prevention of Aortic Aneurysm Rupture

Management Overview (2011 Focused Update)

Class I

1. Open or endovascular repair of infrarenal AAAs and/or common iliac aneurysms is indicated in patients who are good surgical candidates. *(Level of Evidence: A)* (Modified recommendation [endovascular repair incorporated from 2005 Class IIb recommendation; level of evidence changed from B to A].)
2. Periodic long-term surveillance imaging should be performed to monitor for endoleak, confirm graft position, document shrinkage or stability of the excluded aneurysm sac, and determine the need for further intervention in patients who have undergone endovascular repair of infrarenal aortic and/or iliac aneurysms. *(Level of Evidence: A)* (Modified recommendation [level of evidence changed from B to A].)

Class IIa

1. Open aneurysm repair is reasonable to perform in patients who are good surgical candidates but who cannot comply with the periodic long-term surveillance required after endovascular repair. *(Level of Evidence: C)* (New recommendation)

Class IIb

1. Endovascular repair of infrarenal aortic aneurysms in patients who are at high surgical or anesthetic risk as determined by the presence of coexisting severe cardiac, pulmonary, and/or renal disease is of uncertain effectiveness. *(Level of Evidence: B)* (New recommendation)

Visceral Artery Aneurysms

Class I

1. Open repair or catheter-based intervention is indicated for visceral aneurysms measuring 2.0 cm in diameter or larger in women of childbearing age who are not pregnant and in patients of either gender undergoing liver transplantation. *(Level of Evidence: B)*

Class IIa

1. Open repair or catheter-based intervention is probably indicated for visceral aneurysms 2.0 cm in diameter or larger in women beyond childbearing age and in men. *(Level of Evidence: B)*

Lower Extremity Aneurysms

Natural History

Class I

1. In patients with femoral or popliteal aneurysms, ultrasound (or computed tomography or magnetic resonance) imaging is recommended to exclude contralateral femoral or popliteal aneurysms and AAA. *(Level of Evidence: B)*

Management

Class I

1. Patients with a palpable popliteal mass should undergo an ultrasound examination to exclude popliteal aneurysm. *(Level of Evidence: B)*
2. Patients with popliteal aneurysms 2.0 cm in diameter or larger should undergo repair to reduce the risk of thromboembolic complications and limb loss. *(Level of Evidence: B)*
3. Patients with anastomotic pseudoaneurysms or symptomatic femoral artery aneurysms should undergo repair. *(Level of Evidence: A)*

Class IIa

1. Surveillance by annual ultrasound imaging is suggested for patients with asymptomatic femoral artery true aneurysms smaller than 3.0 cm in diameter. *(Level of Evidence: C)*
2. In patients with acute ischemia and popliteal artery aneurysms and absent runoff, catheter-directed thrombolysis or mechanical thrombectomy (or both) is suggested to restore distal runoff and resolve emboli. *(Level of Evidence: B)*
3. In patients with asymptomatic enlargement of the popliteal arteries twice the normal diameter for age and gender, annual ultrasound monitoring is reasonable. *(Level of Evidence: C)*
4. In patients with femoral or popliteal artery aneurysms, administration of antiplatelet medication may be beneficial. *(Level of Evidence: C)*

Catheter-Related Femoral Artery Pseudoaneurysms

Class I

1. Patients with suspected femoral pseudoaneurysms should be evaluated by duplex ultrasonography. *(Level of Evidence: B)*
2. Initial treatment with ultrasound-guided compression or thrombin injection is recommended in patients with large and/or symptomatic femoral artery pseudoaneurysms. *(Level of Evidence: B)*

Class IIa

1. Surgical repair is reasonable in patients with femoral artery pseudoaneurysms 2.0 cm in diameter or larger that persist or recur after ultrasound-guided compression or thrombin injection. *(Level of Evidence: B)*
2. Re-evaluation by ultrasound 1 month after the original injury can be useful in patients with asymptomatic femoral artery pseudoaneurysms smaller than 2.0 cm in diameter. *(Level of Evidence: B)*

Definitions:

2005 Guideline

Classification of Recommendations

Class I: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is beneficial, useful, and effective.

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment.

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy.

Class IIb: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Conditions for which there is evidence and/or general agreement that a procedure/treatment is not useful/effective and in some cases may be harmful.

Levels of Evidence

Level of Evidence A: Data derived from multiple randomized clinical trials or meta-analyses

Level of Evidence B: Data derived from a single randomized trial, or nonrandomized studies

Level of Evidence C: Only consensus opinion of experts, case studies, or standard-of-care

2011 Focused Update

Applying Classification of Recommendations and Level of Evidence

	SIZE OF TREATMENT EFFECT			
	CLASS I	CLASS IIa	CLASS IIb	

		SIZE OF TREATMENT EFFECT			CLASS III *No Benefit* or CLASS III *Harm*	
		Benefit >>> Risk Procedure/Treatment SHOULD be performed/ administered	*Benefit >> Risk* *Additional studies with focused objectives needed* IT IS REASONABLE to perform procedure/administer treatment	*Benefit ≥ Risk* *Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment MAY BE CONSIDERED	Procedure/Test	Treatment
					COR III: No benefit	Not Helpful	No Proven Benefit
					COR III: Harm	Excess Cost w/o Benefit or Harmful	Harmful to Patients
Estimate of Certainty (Precision) of Treatment Effect	LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	• Recommendation that procedure or treatment is useful/effective • Sufficient evidence from multiple randomized trials or meta-analyses	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Sufficient evidence from multiple randomized trials or meta-analyses		
	LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	• Recommendation that procedure or treatment is useful/effective • Limited evidence from single randomized trial or nonrandomized studies	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Evidence from single randomized trial or nonrandomized studies		
	LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	• Recommendation that procedure or treatment is useful/effective • Only expert opinion, case studies, or standard of care	• Recommendation in favor of treatment or procedure being useful/effective • Only diverging expert opinion, case studies, or standard of care	• Recommendation's usefulness/efficacy less well established • Only diverging expert opinion, case studies, or standard of care	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Only expert opinion, case studies, or standard of care		

NOTE: A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Although randomized trials are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective. (See Table 1 in the original guideline document for a list of suggested phrases for writing recommendations.)

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use.

Clinical Algorithm(s)

Clinical algorithms are provided in the original guideline documents (Full-text and Executive Summary) for:

- Steps toward the diagnosis of peripheral arterial disease (PAD)
- Diagnosis and treatment of asymptomatic PAD and atypical leg pain
- Diagnosis of claudication and systemic risk treatment
- Treatment of claudication
- Diagnosis and treatment of critical limb ischemia (CLI)
- Diagnosis of acute limb ischemia
- Treatment of acute limb ischemia
- Clinical clues to the diagnosis of renal artery stenosis
- Indications for revascularization
- Management of abdominal aortic aneurysms
- Diagnostic and treatment algorithm for popliteal mass
- Diagnostic and treatment algorithm for femoral pseudoaneurysm

Scope

Disease/Condition(s)

Peripheral arterial disease (PAD) including:

Lower extremity PAD
Renal arterial disease
Mesenteric arterial disease
Disorders of the abdominal aorta

Guideline Category

Diagnosis

Evaluation

Management

Prevention

Risk Assessment

Treatment

Clinical Specialty

Cardiology

Critical Care

Emergency Medicine

Family Practice

Geriatrics

Internal Medicine

Nephrology

Nursing

Physical Medicine and Rehabilitation

Podiatry

Preventive Medicine

Radiology

Surgery

Intended Users

Advanced Practice Nurses

Health Care Providers

Health Plans

Hospitals

Managed Care Organizations

Nurses

Physical Therapists

Physician Assistants

Physicians

Public Health Departments

Guideline Objective(s)

2005 Guideline

To assist healthcare providers in clinical decision making and care delivery by describing a range of generally acceptable approaches for the prevention, diagnosis, management, and rehabilitation of peripheral arterial disease (PAD), specifically

- To aid in the recognition, diagnosis, and treatment of lower extremity PAD, addressing its high prevalence, impact on quality of life, cardiovascular ischemic risk, and risk of critical limb ischemia (CLI) and amputation
- To aid in the recognition, diagnosis, and treatment of renal and mesenteric arterial diseases
- To improve the detection and treatment of abdominal and branch artery aneurysms

2011 Focused Update

To update the 2005 recommendations for lower extremity and abdominal aortic disease based on new data

Target Population

- Adults with peripheral arterial disease (PAD)
- Adults at risk of PAD

Interventions and Practices Considered

Lower Extremity PAD

Diagnosis/Evaluation

1. Medical history and review of symptoms (ROS)
2. Diagnostic methods
    - Ankle-brachial index (ABI) and toe-brachial index
    - Segmental pressure examination
    - Pulse volume recoding
    - Continuous-wave Doppler ultrasound

- Duplex ultrasound
- Treadmill exercise testing with and without ABI assessments and 6-minute walk test
- Computed tomographic angiography (CTA)
- Magnetic resonance angiography (MRA)
- Contrast angiography

Management/Treatment/Prevention

1. Cardiovascular risk reduction
    - Lipid-lowering drugs (statins, fibric acid derivatives)
    - Antihypertensive drugs (beta-blockers, angiotensin-converting enzyme [ACE] inhibitors)
    - Diabetes management (foot inspection, skin cleansing, glucose control)
    - Smoking cessation (behavioral therapy, nicotine replacement therapy, bupropion, varenicline)
    - Antiplatelet and antithrombotic drugs
    - Note: The following drugs were considered but not recommended: homocysteine-lowering drugs, such as folic acid, vitamin B_{12}
2. Treatment of claudication
    - Supervised exercise programs
    - Pharmacological treatment (cilostazol, pentoxifylline)
    - Note: The following agents were considered but not recommended: L-arginine, propionyl-L-carnitine, ginkgo biloba, oral prostaglandins, vitamin E, chelation
    - Endovascular treatment (e.g., stenting, lasers, atherectomy, percutaneous transluminal angioplasty [PTA], thermal angioplasty)
    - Surgery (inflow and outflow procedures)
3. Treatment for limb salvage (critical limb ischemia [CLI])
    - Parenteral prostaglandins (limited efficacy)
    - Angiogenic growth factors (considered but not recommended outside of clinical trials)
    - Endovascular treatment
    - Thrombolysis
    - Balloon angioplasty
    - Surgery
4. Prevention: vascular ROS and prompt use of the ABI test, comprehensive pulse examination, feet inspection, and review of family history of abdominal aortic aneurysm for patients at risk for lower extremity peripheral arterial disease

<u>Renal Arterial Disease</u>

Diagnostic Studies

1. Noninvasive imaging (e.g., duplex ultrasound, MRA, CTA)
2. Invasive imaging (e.g., abdominal aortography)

Treatment

1. Medical treatment (ACE inhibitors, angiotensin-receptor blockers, calcium-channel blockers, beta-blockers)
2. Percutaneous revascularization via renal artery stent placement and balloon angioplasty
3. Vascular surgical reconstruction

<u>Mesenteric Arterial Disease</u>

1. Management of acute obstructive intestinal ischemia:
    - Surgical treatment including revascularization, resection of necrotic bowel, and "second look" operation if appropriate
    - Endovascular treatment including transcatheter lytic therapy, balloon angioplasty, and stenting
2. Management of nonocclusive intestinal ischemia:
    - Arteriography
    - Treatment of the underlying shock state
    - Laparotomy and resection of nonviable bowel
    - Transcatheter administration of vasodilator medications into the area of vasospasm
3. Management of chronic intestinal ischemia
    - Duplex ultrasound, CTA, MRA, and lateral aortography if needed
    - Percutaneous endovascular treatment
    - Revascularization for patients undergoing aortic/renal artery surgery for other indications

<u>Aneurysms of the Abdominal Aorta, Its Branch Vessels, and the Lower Extremities</u>

1. Management of abdominal aortic and iliac aneurysms
    - Assessment and management of atherosclerotic risk factors
    - Screening high-risk population
    - Open aortic aneurysm repair
    - Endovascular aortic aneurysm repair
    - Prevention of aortic aneurysm rupture
2. Management of visceral artery aneurysms
    - Open repair
    - Catheter-based interventions
3. Management of lower extremity aneurysms
    - Ultrasound, CT, or MR examination
    - Surgical repair
    - Catheter-directed thrombolysis or mechanical thrombectomy or both
    - Antiplatelet medication
4. Management of catheter-related femoral artery pseudoaneurysms
    - Duplex ultrasonography
    - Initial treatment with ultrasound-guided compression or thrombin injection
    - Surgical repair if appropriate
    - Ultrasound re-evaluation

Major Outcomes Considered

- Utility of diagnostic procedures
- Rates of detection of peripheral arterial disease (PAD) in target populations
- Objective and subjective improvement in claudication symptoms
- Cardiovascular ischemic event rates and cardiovascular mortality
- Operative mortality during vascular surgical procedures
- Primary patency and limb salvage rates after endovascular procedure for peripheral artery disease of the lower extremities
- Procedural success rates (cure, improvement, benefit)
- Four-year survival rates in individuals with renal artery stenosis (RAS)
- Rates of detection of abdominal aortic aneurysm (AAA) in target populations
- Risk factors associated with progression of RAS
- Survival rates in patients with abdominal aortic aneurysms

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

2005 Guideline

The Committee to Develop Guidelines for Peripheral Arterial Disease conducted comprehensive searching of the scientific and medical literature relevant to peripheral arterial disease (PAD). Literature searches were conducted in PubMed/MEDLINE and a clinical trials database. Searches were limited to publications in English and human subjects. The committee reviewed all compiled reports from computerized searches and conducted additional searching by hand. Committee members also recommended applicable articles outside the scope of formal searches.

In addition to broad-based searching on PAD, specific targeted searches were performed on the following subtopics: amputation, aneurysm, ankle-brachial index, antihypertensive drugs, antiplatelet and antithrombotic drugs, arteriography, beta blockade, "blue-toe" syndrome, calcification, catheter-based intervention, chronic limb ischemia, claudication, compression, computed tomography, coprevalance of cardiovascular/carotid disease, diabetes, diagnosis, endovascular treatment, etiology, exercise/rehabilitation, femoral pseudoaneurysms, follow-up, homocysteine lowering, imaging, location and prevalence, lower

extremity pulse exam, magnetic resonance angiography, management of ischemia, measurement, medical/pharmacological management, mesenteric, natural history, pathology, pregnancy risk, preoperative assessment/evaluation, prevalence, renal function, smoking cessation, statins, stent, surgical intervention, thrombolysis, ultrasound, vascular surgery. The list of subtopics is not exhaustive.

2011 Focused Update

These updated guideline recommendations reflect a consensus of expert opinion after a thorough review primarily of late-breaking clinical trials identified through a broad-based vetting process as being important to the relevant patient population, as well as other new data deemed to have an impact on patient care. This focused update is not intended to represent an update based on a complete literature review from the date of the previous guideline publication. Specific criteria/considerations for inclusion of new data include the following:

- Publication in a peer-reviewed journal
- Large, randomized, placebo-controlled trial(s)
- Nonrandomized data deemed important on the basis of results affecting current safety and efficacy assumptions, including observational studies and meta-analyses
- Strength/weakness of research methodology and findings
- Likelihood of additional studies influencing current finding
- Impact on current and/or likelihood of need to develop new performance measure(s)
- Request(s) and requirement(s) for review and update from the practice community, key stakeholders, and other sources free of relationships with industry or other potential bias
- Number of previous trials showing consistent results; and
- Need for consistency with a new guideline or guideline updates or revisions.

The results of late-breaking clinical trials presented at the annual scientific meetings of the ACC, AHA, European Society of Cardiology, Society for Vascular Surgery, Society of Interventional Radiology, and Society for Vascular Medicine, as well as selected other data/articles published through December 2010, were reviewed by the 2005 guideline writing committee along with the Task Force and other experts to identify those trials and other key data that may impact guideline recommendations. On the basis of the criteria/considerations noted above, recent trial data and other clinical information were considered important enough to prompt a focused update of the "ACC/AHA 2005 Guidelines for the Management of Patients With Peripheral Arterial Disease (Lower Extremity, Renal, Mesenteric, and Abdominal Aortic)." Because clinical research and clinical care of vascular disease have a global investigative and international clinical care tradition, efforts were made to harmonize this update with the Trans-Atlantic Inter-Society Consensus document on Management of Peripheral Arterial Disease (TASC) and the Inter-Society Consensus for the Management of Peripheral Arterial Disease (TASC II) Steering Committee guideline writing efforts.

To provide clinicians with a comprehensive set of data, whenever deemed appropriate or when published, the absolute risk difference and number needed to treat or harm are provided in the guideline, along with confidence intervals (CIs) and data related to the relative treatment effects, such as odds ratio, relative risk, hazard ratio (HR), or incidence rate ratio.

Number of Source Documents

2005 Guideline

More than 1300 references were used as the major evidence base in the final Guideline, with many times this number of references reviewed by the Committee.

2011 Focused Update

Not stated

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

2005 Guideline

Levels of Evidence

Level of Evidence A: Data derived from multiple randomized clinical trials or meta-analyses

Level of Evidence B: Data derived from a single randomized trial or nonrandomized studies

Level of Evidence C: Only consensus opinion of experts, case studies, or standard-of-care

2011 Focused Update

Applying Classification of Recommendations and Level of Evidence

		SIZE OF TREATMENT EFFECT					
		CLASS I *Benefit >>> Risk* Procedure/Treatment SHOULD be performed/ administered	CLASS IIa *Benefit >> Risk Additional studies with focused objectives needed* IT IS REASONABLE to perform procedure/administer treatment	CLASS IIb *Benefit ≥ Risk Additional studies with broad objectives needed; additional registry data would be helpful* Procedure/Treatment MAY BE CONSIDERED	CLASS III *No Benefit* or CLASS III *Harm*		
						Procedure/Test	Treatment
					COR III: No benefit	Not Helpful	No Proven Benefit
					COR III: Harm	Excess Cost w/o Benefit or Harmful	Harmful to Patients
Estimate of Certainty (Precision) of Treatment Effect	LEVEL A Multiple populations evaluated* Data derived from multiple randomized clinical trials or meta-analyses	• Recommendation that procedure or treatment is useful/effective • Sufficient evidence from multiple randomized trials or meta-analyses	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from multiple randomized trials or meta-analyses	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Sufficient evidence from multiple randomized trials or meta-analyses		
	LEVEL B Limited populations evaluated* Data derived from a single randomized trial or nonrandomized studies	• Recommendation that procedure or treatment is useful/effective • Limited evidence from single randomized trial or nonrandomized studies	• Recommendation in favor of treatment or procedure being useful/effective • Some conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation's usefulness/efficacy less well established • Greater conflicting evidence from single randomized trial or nonrandomized studies	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Evidence from single randomized trial or nonrandomized studies		
	LEVEL C Very limited populations evaluated* Only consensus opinion of experts, case studies, or standard of care	• Recommendation that procedure or treatment is useful/effective • Only expert opinion, case studies, or standard of care	• Recommendation in favor of treatment or procedure being useful/effective • Only diverging expert opinion, case studies, or standard of care	• Recommendation's usefulness/efficacy less well established • Only diverging expert opinion, case studies, or standard of care	• Recommendation that procedure or treatment is not useful/effective and may be harmful • Only expert opinion, case studies, or standard of care		

NOTE: A recommendation with Level of Evidence B or C does not imply that the recommendation is weak. Many important clinical questions addressed in the guidelines do not lend themselves to clinical trials. Although randomized trials are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective. (See Table 1 in the original guideline document for a list of suggested phrases for writing recommendations.)

*Data available from clinical trials or registries about the usefulness/efficacy in different subpopulations, such as gender, age, history of diabetes, history of prior myocardial infarction, history of heart failure, and prior aspirin use.

Methods Used to Analyze the Evidence

Review of Published Meta-Analyses

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

2005 Guideline

Not stated

2011 Focused Update

In analyzing the data and developing recommendations and supporting text, the writing group uses evidence-based methodologies developed by the Task Force. The Class of Recommendation (COR) is an estimate of the size of the treatment effect considering risks versus benefits in addition to evidence and/or agreement that a given treatment or procedure is or is not useful/effective or in some situations may cause harm. The Level of Evidence (LOE) is an estimate of the certainty or precision of the treatment effect. The writing group reviews and ranks evidence supporting each recommendation with the weight of evidence ranked as LOE A, B, or C according to specific definitions that are included in the "Rating Scheme for the Strength of the Evidence" field. Studies are identified as observational, retrospective, prospective, or randomized where appropriate. For certain conditions for which inadequate data are available, recommendations are based on expert consensus and clinical experience and are ranked as LOE C. When recommendations at LOE C are supported by historical clinical data, appropriate references (including clinical reviews) are cited if available. For issues for which sparse data are available, a survey of current practice among the clinicians on the writing group is the basis for LOE C recommendations, and no references are cited. The schema for COR and LOE is summarized in the "Rating Scheme for the Strength of the Evidence" field. Table 1 in the original guideline document provides suggested phrases for writing recommendations within each COR. A new addition to this methodology is a separation of the Class III recommendations to delineate whether the recommendation is determined to be of "no benefit" or is associated with "harm" to the patient. In addition, in view of the increasing number of comparative effectiveness studies, comparator verbs and suggested phrases for writing recommendations for the comparative effectiveness of one treatment or strategy versus another have been added for COR I and IIa, LOE A or B only.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

2005 Guideline

Experts in the subject under consideration are selected from the American College of Cardiology (ACC) and American Heart Association (AHA) and charged with examining subject-specific data and writing or updating these guidelines. The process includes additional representatives from other medical practitioner and specialty groups where appropriate. Writing groups are specifically charged to perform a formal literature review, weigh the strength of evidence for or against a particular treatment or procedure, and include estimates of expected health outcomes where data exist. Patient-specific modifiers, comorbidities, and issues of patient preference that might influence the choice of particular tests or therapies are considered, as well as frequency of follow-up and cost-effectiveness. When available, information from studies on cost will be considered; however, review of data on efficacy and clinical outcomes will be the primary basis for preparing recommendations in these guidelines.

This guideline was developed by a writing committee whose members had expertise in vascular medicine and cardiovascular medicine, vascular surgery, vascular and interventional radiology, and hypertension and renal disease, with committee membership derived from the ACC, the AHA, the Society for Vascular Surgery, the Society of Interventional Radiology, the Society for Vascular Medicine and Biology, the Society for Cardiovascular Angiography and Interventions, the ACC Board of Governors, and the ACC/AHA Task Force on Practice Guidelines.

This writing committee recognizes the prodigious effort and international contribution of the "Management of Peripheral Arterial Disease" document developed by the TransAtlantic Inter-Society Consensus (TASC) Working Group (http://www.tasc-2-pad.org/). The TASC is an internationally

derived, collaboratively created consensus that provides an evidence-based, detailed review of the diagnosis and treatment of intermittent claudication, acute limb ischemia, and critical limb ischemia (CLI). The efforts of TASC have defined the standard of excellence in the treatment of peripheral arterial disease. At this writing, the TASC Working Group is in the process of updating its 2000 document. Readers are encouraged to consult, in addition to this guideline, the revised TASC document when it becomes available.

The ACC/AHA Writing Committee was charged with building on the work of TASC to create a guideline for a broader audience to include primary care clinicians as well as vascular specialists.

2011 Focused Update

In an effort to respond promptly to new evidence, the American College of Cardiology Foundation/American Heart Association (ACCF/AHA) Task Force on Practice Guidelines (Task Force) has created a "focused update" process to revise the existing guideline recommendations that are affected by the evolving data or opinion. New evidence is reviewed in an ongoing fashion to more efficiently respond to important science and treatment trends that could have a major impact on patient outcomes and quality of care. Evidence is reviewed at least twice a year, and updates are initiated on an as-needed basis and completed as quickly as possible while maintaining the rigorous methodology that the ACCF and AHA have developed during their partnership of >20 years.

For this focused update, all *eligible* members of the 2005 writing committee were invited to participate; those who agreed (referred to as the 2011 focused update writing group) were required to disclose all relationships with industry (RWI) relevant to the data under consideration. In addition, new members were invited in order to preserve the required RWI balance. The writing group included representatives from the ACCF, AHA, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society for Vascular Medicine, and Society for Vascular Surgery.

Rating Scheme for the Strength of the Recommendations

2005 Guideline

Class I: Conditions for which there is evidence and/or general agreement that a given procedure or treatment is beneficial, useful, and effective

Class II: Conditions for which there is conflicting evidence and/or a divergence of opinion about the usefulness/efficacy of a procedure or treatment

Class IIa: Weight of evidence/opinion is in favor of usefulness/efficacy.

Class IIb: Usefulness/efficacy is less well established by evidence/opinion.

Class III: Conditions for which there is evidence and/or general agreement that a procedure/treatment is not useful/effective and in some cases may be harmful.

2011 Focused Update

See "Rating Scheme for the Strength of the Evidence" field above.

Cost Analysis

The guideline developers reviewed published cost analyses.

Method of Guideline Validation

External Peer Review

Internal Peer Review

Description of Method of Guideline Validation

2005 Guideline

This document was approved by the American College of Cardiology Foundation (ACCF) Board of Trustees in October 2005 and by the American Heart Association (AHA) Science Advisory and Coordinating Committee in October 2005.

2011 Focused Update

This document was reviewed by 2 official reviewers each nominated by the ACCF and the AHA, as well as 2 reviewers each from the Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society for Vascular Medicine, and Society for Vascular Surgery; and 13 individual content reviewers (including members from the following groups: ACCF/AHA Task Force on Clinical Data Standards, ACCF Interventional Scientific Council, 2005 Peripheral Artery Disease Writing Committee, ACCF/AHA Task Force on Performance Measures, ACCF Prevention Committee,

and ACCF Peripheral Vascular Disease Committee). All information on reviewers' relationships with industry (RWI) was distributed to the writing group and is published in the original guideline document (Appendix 2).

This document was approved for publication by the governing bodies of the ACCF and AHA and endorsed by the Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society for Vascular Medicine, and Society for Vascular Surgery.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Improved (prompt, accurate, and cost-effective) diagnosis linked to provision of integrated lifelong management of peripheral arterial disease
Decreased rates of cardiovascular ischemic events (myocardial infarction and stroke) and cardiovascular death
Decreased rates of critical limb ischemia and amputation
Decreased rates of ischemic renal failure, and diminished morbidity and mortality due to mesenteric ischemia and aortic aneurysmal rupture
Improved quality of life

Potential Harms

Adverse Effects of Medications

- Antihypertensive therapy may decrease limb perfusion pressure and potentially exacerbate symptoms of claudication or critical limb ischemia.
- Aspirin and clopidogrel increase the risk of intracranial and gastrointestinal bleeding.
- The most common side effects of cilostazol include headache, diarrhea, abnormal stools, palpitations, and dizziness; cilostazol should not be used in patients with heart failure.
- Adverse effects associated with pentoxifylline include sore throat, dyspepsia, nausea, and diarrhea.

Vascular Diagnostic Tools

- Catheter-based contrast angiography is associated with a low rate of serious adverse outcomes in individuals with normal renal function. However, the risk of contrast-induced acute renal failure is magnified in certain clinical groups, particularly those with diabetes and chronic kidney disease. In general, the incidence of contrast-induced acute renal failure is less than 3% in patients with neither diabetes nor chronic kidney disease; 5% to 10% in those with diabetes; 10% to 20% in those with chronic kidney disease (and greater with more advanced stages), and 20% to 50% in those with both diabetes and chronic kidney disease.
- See Table 15 in the original guideline documents for limitations of noninvasive and invasive vascular diagnostic tools.

Surgical Procedures

- Surgical procedures are associated with intraoperative and postoperative complications including an associated cardiovascular ischemic risk and device-related complications and graft-related complications (e.g., pseudoaneurysms, graft thrombosis, enteric fistulas, graft infections, death)
- Mechanical thrombectomy devices are associated with hemorrhage, embolization, acute occlusion, amputation (refer to Table 27 in the original guideline document for more details)

Contraindications

Contraindications

- Magnetic resonance angiography is contraindicated in patients with pacemakers, defibrillators, intracranial metallic stents, clips, coils, and other devices
- The history of an allergic reaction to contrast agents may serve as a relative procedural contraindication to angiography.
- Because of bleeding risks, thrombolysis may be contraindicated in some patients.

- Duplex sonography is contraindicated in patients with suspected acute intestinal ischemia because of the need for emergent treatment and the time required to attempt duplex scanning.

Qualifying Statements

Qualifying Statements

2005 Guideline

These practice guidelines are intended to assist healthcare providers in clinical decision making by describing a range of generally acceptable approaches for the prevention, diagnosis, and lifelong management of specific diseases or conditions. These guidelines attempt to define practices that meet the needs of most patients in most circumstances. These guideline recommendations reflect a consensus of expert opinion after a thorough review of the available, current scientific evidence and are intended to improve patient care. If these guidelines are used as the basis for regulatory/payer decisions, the ultimate goal is quality of care and serving the patient's best interests. The ultimate judgment regarding care of a particular patient must be made by the healthcare provider and patient in light of all of the circumstances presented by that patient.

2011 Focused Update

- These practice guidelines are intended to assist healthcare providers in clinical decision making by describing a range of generally acceptable approaches to the diagnosis, management, and prevention of specific diseases or conditions. The guidelines attempt to define practices that meet the needs of most patients in most circumstances. The ultimate judgment regarding care of a particular patient must be made by the healthcare provider and patient in light of all the circumstances presented by that patient. As a result, situations may arise for which deviations from these guidelines may be appropriate. Clinical decision making should involve consideration of the quality and availability of expertise in the area where care is provided. When these guidelines are used as the basis for regulatory or payer decisions, the goal should be improvement in quality of care. The Task Force recognizes that situations arise in which additional data are needed to inform patient care more effectively; these areas will be identified within each respective guideline when appropriate.
- Prescribed courses of treatment in accordance with these recommendations are effective only if followed. Because lack of patient understanding and adherence may adversely affect outcomes, physicians and other healthcare providers should make every effort to engage the patient's active participation in prescribed medical regimens and lifestyles. In addition, patients should be informed of the risks, benefits, and alternatives to a particular treatment and be involved in shared decision making whenever feasible, particularly for Class of Recommendation (COR) IIa and IIb, for which the benefit-to-risk ratio may be lower.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Clinical Algorithm

Pocket Guide/Reference Cards

Quick Reference Guides/Physician Guides

Slide Presentation

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

Living with Illness

Staying Healthy

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Hirsch AT, Haskal ZJ, Hertzer NR, Bakal CW, Creager MA, Halperin JL, Hiratzka LF, Murphy WR, Olin JW, Puschett JB, Rosenfield KA, Sacks D, Stanley JC, Taylor LM Jr, White CJ, White J, White RA. ACC/AHA 2005 guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic): a collaborative report [trunc]. Bethesda (MD): American College of Cardiology Foundation; 2005. 192 p. [1308 references]

Rooke TW, Hirsch AT, Misra S, Sidawy AN, Beckman JA, Findeiss LK, Golzarian J, Gornik HL, Halperin JL, Jaff MR, Moneta GL, Olin JW, Stanley JC, White CJ, White JV, Zierler RE, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society for Vascular Medicine, Society for Vascular Surgery. 2011 ACCF/AHA focused update of the guideline for the management of patients with peripheral artery disease (updating the 2005 guideline): a report of the American College of Cardiology Foundation/American Heart Association Task Force [trunc]. J Am Coll Cardiol. 2011 Nov 1;58(19):2020-45. [66 references] PubMed

Adaptation

The ACC/AHA Writing Committee was charged with building on the work of TransAtlantic Inter-Society Consensus (TASC) to create a guideline for a broader audience.

Date Released

2005 (addendum released 2011 Nov 1)

Guideline Developer(s)

American College of Cardiology Foundation - Medical Specialty Society

American Heart Association - Professional Association

Source(s) of Funding

The American College of Cardiology Foundation and the American Heart Association. No outside funding accepted.

Guideline Committee

Writing Committee to Develop Guidelines for the Management of Patients with Peripheral Arterial Disease

American College of Cardiology/American Heart Association Task Force on Practice Guidelines

Composition of Group That Authored the Guideline

2005 Guideline

Writing Committee Members: Alan T. Hirsch, MD, FACC, FAHA (*Chair*); Ziv J. Haskal, MD, FAHA, FSIR (*Co-Chair*); Norman R. Hertzer, MD,

FACS, *Co-Chair*; Curtis W. Bakal, MD, MPH, FAHA; Mark A. Creager, MD, FACC, FAHA; Jonathan L. Halperin, MD, FACC, FAHA[1]; Loren F. Hiratzka, MD, FACC, FAHA, FACS; William R.C. Murphy, MD, FACC, FACS; Jeffrey W. Olin, DO, FACC; Jules B. Puschett, MD, FAHA; Kenneth A. Rosenfield, MD, FACC; David Sacks, MD, FACR, FSIR[3]; James C. Stanley, MD, FACS, FACR, FSIR[2]; Lloyd M. Taylor, Jr., MD, FACS[2]; Christopher J. White, MD, FACC, FAHA, FESC, FSCAI[4]; John White, MD, FACS[2]; Rodney A. White, MD, FACS[2]

Task Force Members: Elliott M. Antman, MD, FACC, FAHA (*Chair*); Sidney C. Smith, Jr., MD, FACC, FAHA (*Vice-Chair*); Cynthia D. Adams, MSN, APRN-BC, FAHA; Jeffrey L. Anderson, MD, FACC, FAHA; David P. Faxon, MD, FACC, FAHA[5]; Valentin Fuster, MD, PhD, FACC, FAHA, FESC[5]; Raymond J. Gibbons, MD, FACC, FAHA[6]; Jonathan L. Halperin, MD, FACC, FAHA; Loren F. Hiratzka, MD, FACC, FAHA[5]; Sharon A. Hunt, MD, FACC, FAHA; Alice K. Jacobs, MD, FACC, FAHA; Rick Nishimura, MD, FACC, FAHA; Joseph P. Ornato, MD, FACC, FAHA; Richard L. Page, MD, FACC, FAHA; Barbara Riegel, DNSc, RN, FAHA

[1]Society for Vascular Medicine and Biology official representative

[2]Society for Vascular Surgery official representative

[3]Society of Interventional Radiology official representative

[4]Society for Cardiovascular Angiography and Interventions official representative

[5]Former Task Force member during this effort

[6]Immediate Past Chair

2011 Focused Update

Writing Group Members: Thom W. Rooke, MD, FACC (*Chair*)†; Alan T. Hirsch, MD, FACC (*Vice Chair*); Sanjay Misra, MD (*Vice Chair*)‡; Anton N. Sidawy, MD, MPH, FACS (*Vice Chair*)§; Joshua A. Beckman, MD, FACC, FAHA*; Laura K. Findeiss, MD‡; Jafar Golzarian, MD†; Heather L. Gornik, MD, FACC, FAHA†; Jonathan L. Halperin, MD, FACC, FAHA¶; Michael R. Jaff, DO, FACC†; Gregory L. Moneta, MD, FACS†; Jeffrey W. Olin, DO, FACC, FAHA#; James C. Stanley, MD, FACS†; Christopher J. White, MD, FACC, FAHA, FSCAI**; John V. White, MD, FACS†; R. Eugene Zierler, MD, FACS†

Task Force Members: Alice K. Jacobs, MD, FACC, FAHA, Chair; Jeffrey L. Anderson, MD, FACC, FAHA, Chair-Elect; Nancy Albert, PhD, CCNS, CCRN, FAHA; Mark A. Creager, MD, FACC, FAHA; Steven M. Ettinger, MD, FACC; Robert A. Guyton, MD, FACC; Jonathan L. Halperin, MD, FACC, FAHA; Judith S. Hochman, MD, FACC, FAHA; Frederick G. Kushner, MD, FACC, FAHA; E. Magnus Ohman, MD, FACC; William Stevenson, MD, FACC, FAHA; Clyde W. Yancy, MD, FACC, FAHA

†ACCF/AHA Representative

‡Society of Interventional Radiology Representative

§Society for Vascular Surgery Representative

*Society for Vascular Medicine Representative

¶ACCF/AHA Task Force on Practice Guidelines Liaison

#ACCF/AHA Task Force on Performance Measures Liaison

**Society for Cardiovascular Angiography and Interventions Representative

Financial Disclosures/Conflicts of Interest

2005 Guideline

The American College of Cardiology/American Heart Association (ACC/AHA) Task Force on Practice Guidelines makes every effort to avoid any actual, potential, or perceived conflicts of interest that might arise as a result of an outside relationship or personal interest of a member of the writing panel. Specifically, all members of the writing panel are asked to provide disclosure statements of all such relationships that might be perceived as real or potential conflicts of interest. These statements are reviewed by the parent task force, reported orally to all members of the writing panel at each meeting, and updated and reviewed by the writing committee yearly and as changes occur.

See Appendix 1 in the original 2005 guideline document for author relationships with industry and Appendix 2 for peer reviewer relationships with industry.

2011 Focused Update

The Task Force makes every effort to avoid actual, potential, or perceived conflicts of interest that may arise as a result of industry relationships or personal interests among the members of the writing group. All writing group members and peer reviewers of the guideline are asked to disclose all such current relationships as well as those existing 12 months previously. In December 2009, the ACCF and AHA implemented a new policy for relationships with industry and other entities (RWI) that requires the writing group chair plus a minimum of 50% of the writing group to have no *relevant* RWI (see Appendix 1 in the 2011 Focused Update document for the ACCF/AHA definition of relevance). These statements are reviewed by the Task Force and all members during each conference call and/or meeting of the writing group and are updated as changes occur. All guideline recommendations require a confidential vote by the writing group and must be approved by a consensus of the voting members. Members are not permitted to write, and must recuse themselves from voting on, any recommendation or section to which their RWI apply. Members who recused themselves from voting are indicated in the list of writing group members, and section recusals are noted in Appendix 1 of the 2011 Focused Update document. Authors' and peer reviewers' RWI pertinent to this guideline are disclosed in Appendixes 1 and 2 of the 2011 Focused Update document, respectively. Additionally, to ensure complete transparency, writing group members' comprehensive disclosure information—including RWI not pertinent to this document—is available as an online supplement. Comprehensive disclosure information for the Task Force is also available online at http://www.cardiosource.org/ACC/About-ACC/Leadership/Guidelines-and-Documents-Task-Forces.aspx. The work of the writing group was supported exclusively by the ACCF and AHA without commercial support. Writing group members volunteered their time for this activity.

Guideline Endorser(s)

American Association of Cardiovascular and Pulmonary Rehabilitation - Medical Specialty Society

National Heart, Lung, and Blood Institute (U.S.) - Federal Government Agency [U.S.]

Society for Vascular Nursing - Nonprofit Organization

TransAtlantic Inter-Society Consensus - Independent Expert Panel

Vascular Disease Foundation - Professional Association

Guideline Status

This is the current release of the guideline.

Guideline Availability

2005 Guideline

Electronic copies: Available from the American College of Cardiology (ACC) Web site and from the American Heart Association (AHA) Web site.

2011 Focused Update

Electronic copies: Available from the American College of Cardiology Web site and from the Circulation Web site.

Print copies: Available from the American College of Cardiology, 9111 Old Georgetown Road, Bethesda, Maryland 20814-1699.

Availability of Companion Documents

The following are available:

- ACC/AHA 2005 guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic). A collaborative report from the American Association for Vascular Surgery/Society for Vascular Surgery*, Society for Cardiovascular Angiography and Interventions, Society of Interventional Radiology, Society for Vascular Medicine and Biology, and the ACC/AHA Task Force on Practice Guidelines (Writing Committee to Develop Guidelines for the Management of Patients With Peripheral Arterial Disease [Lower Extremity, Renal, Mesenteric, and Abdominal Aortic]): executive summary. Electronic copies: Available from the Journal of the American College of Cardiology (JACC) Web site.
- Management of patients with peripheral artery disease (lower extremity, mesenteric, and abdominal aortic). Pocket guideline. Bethesda (MD): American College of Cardiology/American Heart Association. 2011. 62 p. Electronic copies: Available from the ACC Web site.
- 2011 ACCF/AHA focused update of the guideline for the management of patients with peripheral artery disease. Slide set. Bethesda (MD): American College of Cardiology/American Heart Association. 2005. 187 p. Electronic copies: Available from the JACC Web site.

- 2011 ACCF/AHA focused update of the guideline for the management of patients with peripheral artery disease. Slide set. Bethesda (MD): American College of Cardiology/American Heart Association. 2011 Nov. 142 p. Electronic copies: Available from the JACC Web site .
- Methodology manual and policies from the ACCF/AHA Task Force on Practice Guidelines. 2010 Jun. 88 p. American College of Cardiology Foundation and American Heart Association, Inc. Electronic copies: Available in PDF from the ACC Web site .

Print copies: Available from the ACC, 2400 N Street NW, Washington DC, 20037; (800) 253-4636 (US only)

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI on February 3, 2006. The information was verified by the guideline developer on May 16, 2006. This summary was updated by ECRI Institute on May 17, 2007 following the U.S. Food and Drug Administration (FDA) advisory on Gadolinium-based contrast agents. This summary was updated by ECRI Institute on June 20, 2007 following the U.S. Food and Drug Administration (FDA) advisory on gadolinium-based contrast agents. This summary was updated by ECRI Institute on November 9, 2007, following the U.S. Food and Drug Administration advisory on Antidepressant drugs. This summary was updated by ECRI Institute on July 20, 2009 following the U.S. Food and Drug Administration advisory on Varenicline and Bupropion. This summary was updated by ECRI Institute on January 4, 2010 following the U.S. Food and Drug Administration advisory on Plavix (Clopidogrel). This summary was updated by ECRI Institute on May 17, 2010 following the U.S. Food and Drug Administration advisory on Plavix (clopidogrel). This NGC summary was updated by ECRI Institute on May 21, 2012. The updated information was verified by the guideline developer on June 5, 2012. This summary was updated by ECRI Institute on January 14, 2013 following the revised U.S. Food and Drug Administration advisory on Chantix (varenicline). This summary was updated by ECRI Institute on April 8, 2015 following the U.S. Food and Drug Administration advisory on Chantix (varenicline).

Copyright Statement

Disclaimer

NGC Disclaimer